

REMARKS

Amendments to the Specification and Drawings

The amendments to the specification are not new matter.

The new paragraph added to discuss new Figure 9 and new Figure 9 itself is supported by the specification as discussed in ¶¶13-16 of the Declaration of Michael Durham under 37 CFR 1.132 ("Durham Declaration") filed concurrently herewith.

The new text added at page 18, line 10, is the text of the U.S. provisional application Serial No. 60/213,915, filed June 26, 2000 ("Provisional Application"). This application is incorporated into the specification by reference at page 1, lines 8-11.

Information Disclosure Statement

The Examiner objects to the Information Disclosure Statement filed July 18, 2003, (IDS) as failing to comply with 37 CFR 1.98(a)(2). According to the Examiner, the IDS "has been placed in the application file, but the information referred to therein has not been considered." When reviewing the attachments to the Office Action, however, all but a few of the individual references in the PTO 1449's from the IDS have been initialed by the Examiner. Applicant seeks clarification that the initialed references have indeed been considered.

Regarding the basis for the objection, Applicant respectfully notes that 37 CFR 1.98(d): (i) permits applications filed after June 30, 2003, to no longer require submission of copies of U.S. patent applications and patents, and (ii) permits applications claiming priority from an earlier application under 35 USC § 120 to exclude copies of references cited in the earlier application. Nonetheless, the IDS has been refiled in its entirety concurrently herewith including copies of the nonpatent references. Applicant respectfully requests consideration of the references disclosed therein. In the event that the previously initialed references have been considered, Applicant requests that only the previously uninitialed references be considered.

Drawings

The drawings are objected to under 37 CFR 1.83(a). Attached hereto is a proposed Figure 9 overcoming the objection without adding new matter.

Claim Objections

The Examiner objects to claims 18 and 23 under 37 CFR 1.75(c) as being of improper dependent form. Claims 18 and 23 have been amended to overcome the objection.

Claim Rejections

The Examiner has rejected Claims 1-36 under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. According to the Examiner, the claims contain subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

For the reasons set forth below with respect to each rejected claim limitation, Applicant respectfully traverses the claim rejections.

The subject matter of a later claim need not be described literally or “*in haec verba*” in order for the specification to satisfy the description requirement. *Purdue Pharma L.P. v. Faulding Inc.*, 230 F.3d 1320, 1323, 50 USPQ2d 1481, 1483 (Fed. Cir. 2000). The failure of the specification to specifically mention a limitation that later appears in the claims is not fatal if the person skilled in the art would recognize, upon reading the specification, that the new language reflects what the specification shows has been invented. *All Dental Prodx LLC v. Advantage Dental Products Inc.*, 309 F.3d 774, 779, 64 USPQ2d 1945, 1948 (Fed. Cir. 2002).

The Requirement of Claim 1 that the Iron-Bearing Material Include at Least One Carbon Compound

Claim 1 requires the iron-bearing material to contain at least one carbon compound to promote reduction of iron oxides.

As set forth in ¶¶9-11 of the Declaration of Ramon Bisque under 37 CFR § 1.132, filed concurrently herewith (“Bisque Declaration”), this limitation is contained in the specifications of each of the above-referenced utility application (“Subject Application”) and the priority application, namely U.S. Provisional Application Serial No. 60/213,915, filed June 26, 2000, entitled “Low Cost Technology to Improve Operation of Cyclone Furnaces Firing Low-Sulfur Western Coals” (“Provisional Application”).

According to ¶10 of the Bisque Declaration, though the Shepard patent fails to identify the precise carbon compound(s) referenced by this phrase, it states at col. 8, lines 13-16, that “[c]arbon may be present in the iron-bearing materials in the form of, for example, blast furnace flue dust, or carbon may be added to these materials to promote reduction of the iron oxides to more readily flux the fuel ash.” From this sentence, the carbon referenced in the Shepard patent is likely in the form of elemental carbon, coke, and hydrocarbons. The Subject and Provisional Applications each reference a number of carbon compounds that would be understood by one of ordinary skill in the art to promote reduction of iron oxides, such as hematite, magnetite, and wustite, under the thermal conditions of the combustion chamber. These compounds include hydrocarbons in the coal feed itself (Provisional Application at page 7 and Subject Application at page 6, lines 6-14); oils and greases (Provisional Application at page 4 and Subject Application at page 12, lines 14-17); xanthum gum (Provisional Application at page 6 and Subject Application at page 13, lines 10-13); and residual hydrocarbons remaining in the boiler slag, which may be added to the iron-bearing material as a flow aid (Provisional Application at page 8 and Subject Application at page 15, lines 1-2). Moreover, as admitted in part by the Shepard patent, iron-oxide reducing carbon compound(s) will be inherently present in the iron-bearing material itself when the iron-bearing material is a byproduct of steel and iron manufacturing, such as Basic Oxygen Furnace or BOF flue dust or precipitator fines, blast furnace flue dust, electric arc furnace dust, and mill scale fines (Provisional Application at page 4 and Subject Application at page 12, lines 7-12, and page 18, lines 13-14).

For these reasons, one of ordinary skill in the art, based on the specifications of the Subject Application and Provisional Application, would conclude that, at the time each application was filed, the inventors had possession of an iron-containing additive containing at least one carbon compound to promote reduction of iron oxides in the iron-containing additive. (Bisque Declaration at ¶11) The Requirement of Claims 1, 19, and 24 that, in the Presence of the Iron-Bearing Material, at Least One AFT Property of the Ash is Reduced

Claims 1 and 19 each require, during the combustion of the solid fuel in the presence of the iron-bearing material, at least one ash fusion temperature characteristic selected from the group

consisting of initial deformation temperature, softening temperature, hemispherical temperature, and fluid temperature is less than the same ash fusion temperature characteristic of a second ash slag produced from combustion of the solid fuel alone. Claim 24 requires at least a portion of the iron bearing material to flux the ash slag to produce a composite ash slag having at least one ash fusion temperature characteristic selected from the group consisting of initial deformation temperature, softening temperature, hemispherical temperature, and fluid temperature less than the same ash fusion temperature characteristic of the ash slag produced from combustion of the solid fuel alone.

As set forth in ¶¶8 and 12-20 of the Bisque Declaration, this limitation is contained in the specifications of each of the Subject Application and the Provisional Application. At the outset, it is important to understand that, in certain embodiments, the Provisional Application, Subject Application, and Shepard Patent are directed to the same invention. They each disclose the combustion of the same fuel in the same type of combustion chamber in the presence of the same iron-bearing material additive under the same temperature regime. The fuel is a low sulfur western or eastern coal (*see, e.g.*, Provisional Application at pages 1 and 3; Subject Application at Figure 2, page 2, lines 15-17, page 3, lines 9-12, page 4, lines 3-4 and 7-9, and page 6, lines 4-5; and Shepard Patent at col. 1, line 62-col. 2, line 3, col. 3, lines 26-34 and 55-57 and Fuels 3 and 4). The combustion chamber is a "slag tap" or "wet bottom" boiler, such as a cyclone-type boiler (*see, e.g.*, Provisional Application at pages 1-5 and 7-8; Subject Application at Figure 1, page 1, lines 18-26, page 5, lines 16-17, page 6, lines 4-5 and 15-18, and page 18, lines 12-13; and Shepard Patent at col. 2, lines 7-8, col. 4, lines 7-10). The iron-bearing material is mill scale from steel production or dust from blast furnace gas cleaning equipment (*see, e.g.*, Provisional Application at pages 4 and 6; Subject Application at page 12, lines 7-12; and Shepard Patent at col. 4, lines 15-16, col. 8, lines 4-5). The temperature regime is that necessary to combust the solid fuel and melt the ash content of the fuel to form slag. (*see, e.g.*, Provisional Application at pages 1-5 and 7-8; Subject Application at page 2, lines 14-15, page 6, lines 4-5 and lines 15-18, Figures 7-8 and page 20, lines 1-21; and Shepard Patent at col. 2, lines 4-50, col. 5, lines 10-50). In chemistry, it is elementary that the use of the same reactants under the same reaction conditions in the same reactor will produce the same

results. Thus, the various claim limitations discussed below are inherent in the disclosures of the Provisional Application and Subject Application. (Bisque Declaration at ¶8)

Moreover, the Provisional and Subject Applications specifically state that the iron-bearing additive lowers the ash melting temperature and therefore implies that it also lowers the AFT characteristics. The Subject and Provisional Applications each state that the iron-bearing additive fluxes the ash (Provisional Application at pages 3-4, 5, and 7 and Subject Application at page 5, lines 13-14, page 6, lines 19-22, page 8, lines 10-11) and lowers the melting temperature of the ash (Provisional Application at page 1 and Subject Application at page 7, lines 15-18, Figures 7-8, and page 20, lines 1-21). The AFT characteristics of initial deformation temperature, softening temperature, hemispherical temperature, and fluid temperature represent a continuum of constituent melting points leading to the complete melting of the ash. The characteristics are arbitrary and established by subjective visual observation. (Bisque Declaration at ¶13)

According to pages 20-5 through 20-7 of "*Steam/its generation and use*", by Babcock & Wilcox (1972) ("the Babcock & Wilcox Article" attached to the Bisque Declaration as Exhibit "A"), the AFT properties are determined as part of the ASTM Standard D 1857, *Fusibility of Coal and Coke Ash*". According to the standard, an ash sample is prepared by burning coal under oxidizing conditions at temperatures of 1470 to 1650°F. The ash is pressed into a mold to form a triangular pyramid cone 0.75 in. in height with a 0.25 in. triangular base. The cone is heated in a furnace at a controlled rate to provide a temperature increase of 15°F per minute. The initial deformation temperature (IT or ID) refers to the temperature at which the tip of the pyramid begins to fuse or show signs of deformation. The softening temperature (ST) is the temperature at which the sample has deformed to a spherical shape where the height of the cone is equal to the width at the base ( $H=W$ ). The softening temperature is commonly referred to as the fusion temperature. The hemispherical temperature (HT) is the temperature at which the cone has fused down to a hemispherical lump and the height equals one half the width of the base ( $H=1/2W$ ). The fluid temperature (FT) is the temperature at which the ash cone has melted to a nearly flat layer with a maximum height of 0.0625 in. (Bisque Declaration at ¶14)

It is well known that each of the AFT characteristics, namely IT, ST, HT, and FT, represent a melting point of one or more ash constituents. Regarding the relationship between the AFT properties and the melting point of the ash, the Babcock & Wilcox Article states:

The gradual deformation of the ash cone is generally considered to result from differences in melting characteristics of the various ash constituents. As the temperature of the sample is increased, compounds with lowest melting temperature begin to melt, causing the initial deformation. As the temperature continues to increase, more of the compounds melt and the degree of deformation proceeds to the softening and hemispherical stages. The process continues until the temperature is higher than the melting point of most of the ash constituents and the fluid stage is reached.

(The Babcock & Wilcox Article at page 20-6.) (Bisque Declaration at ¶15)

For at least these reasons at the times that the Subject and Provisional Applications were filed, the Bisque Declaration concludes that one of ordinary skill in the art would understand the phrase, “melting temperature of the ash” (as used in the Subject Application and Provisional Application), to refer to the last (or highest) of a sequence of melting points for differing ash constituents and require that each of the lower melting point constituents have melted. The melting temperature of the ash is therefore synonymous with the fluid temperature. (Bisque Declaration at ¶16)

Regarding the AFT-characteristic limitation and the fluxing limitation, namely that the “iron bearing material fluxes the ash slag” in claims 1, 11, 19, 24 and 33 (*see* Office Action at pages 3, 4, 5, and 33), the Provisional and Subject Applications further use the term “flux” and “fluxing agent”. (Provisional Application at pages 1, 3-4, and 6-8 and Subject Application at page 5, lines 13-14, page 6, lines 19-22, page 8, lines 10-11). According to *Hawley’s Condensed Chemical Dictionary*, “flux” is defined as “[a] substance that promotes fusing of minerals or metals or prevents the formation of oxides.” It further defines “fuse” as “[o]f a solid, to *melt*, e.g., a fused salt.” (Emphasis supplied.) The terms “flux” and “fuse” would further suggest to one of ordinary skill in the art that the various melting points of the ash constituents, denoted by the AFT properties, are lowered by the iron-bearing additive

disclosed in the Provisional Application and Subject Application. (Bisque Declaration at ¶17)

Claims 1, 19, and 24 further require the iron-bearing material to cause a reduction in at least one AFT characteristic and ash slag melting point relative to the ash slag in the absence of the iron-bearing material. The Provisional and Subject Applications refer to the iron-containing additive lowering the  $T_{250}$  (or the temperature at which the ash would have a viscosity of 250 poise, which is an important indicator for the minimum temperature at which the slag will flow) for low-sulfur eastern and western coals having low iron and high calcium contents. (Provisional Application at pages 1 and 4-5 and Subject Application at Figure 2, page 2, lines 15-17, page 7, lines 15-18, page 9, lines 14-15, page 19, lines 5-10, Figures 7-8 and page 20, lines 3-21). As shown in Figures 7-8 of the Subject Application, the iron-containing additive lowers the slag viscosity, at temperatures above about 2275°F, compared to a slag when no additive is used. It is inherent that lowering the  $T_{250}$  of low-sulfur coals having low iron and high calcium contents and low-sulfur eastern coals will lower each of the AFT properties referenced above. (Bisque Declaration at ¶¶18 and 20)

For at least the reasons set forth above, the Bisque Declaration concludes that the AFT-characteristic and fluxing limitations are each described in the specifications of both the Provisional and Subject Applications in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time each of the applications was filed, had possession of the claimed invention. (Bisque Declaration at ¶19)

The Requirement of Claims 1, 11, 19, 24, and 33 that, During Solid Fuel (Coal) Combustion, the Iron-Bearing Material Fluxes the Ash Slag to Produce a Composite Slag

Claims 1, 19, and 24 each require that, during solid fuel (coal) combustion, the iron-bearing material fluxes the ash slag to produce a composite slag. Claims 11 and 33, which are dependent claims, include a similar limitation.

As set forth above and in ¶¶12-20 of the Bisque Declaration, this limitation is contained in the specifications of each of the Subject and the Provisional Applications.

The Requirement of Claims 2 and 20 that the Solid Fuel is a Sub-Bituminous Coal

Claims 2 and 20 require the solid fuel to include a sub-bituminous coal.

As set forth in ¶¶7-8 of the Durham Declaration, this limitation is contained in the specifications of each of the Subject and the Provisional Applications.

According to the Durham Declaration, the Subject and Provisional Applications each reference coals from the Powder River Basin of Montana and Wyoming (Provisional Application at pages 3-5 and 8; Subject Application at page 1, lines 8-11) and the Subject Application refers specifically to “sub-bituminous coal” as the solid fuel feed (Subject Application at page 6, line 9). Because coal in the Powder River Basin is primarily sub-bituminous coal, the Durham Declaration concludes that the reference to the Powder River Basin would convey to one skilled in the relevant art that the inventors, at the time the Provisional and Subject Applications were filed, had possession of the invention claimed in claims 2 and 20. (Durham Declaration at ¶8)

The Requirement of Claims 3, 17, 22, and 36 that at Least one AFT Characteristic or the Melting Point of the Ash Slag be less than 2600°F

Claim 3 requires that at least one AFT characteristic be less than 2600°F. Claims 17, 22, and 36 each require that the melting point of the composite ash slag be less than 2600°F.

As set forth in ¶¶21-23 of the Bisque Declaration, this limitation is contained in the specifications of each of the Subject and the Provisional Applications. The Provisional Application at page 1 and the Subject Application at page 2, lines 14-15, disclose that the ash (from which the molten slag is formed), in cyclone boilers, must be melted at normal combustion temperatures ranging from 2,600 to 3,000°F. Moreover, the Subject Application at page 20 and in Figure 7 shows that the ash/slag is melted at a temperature below 1,900°F. (Bisque Declaration at ¶22)

According to the Bisque Declaration for at least the reasons set forth above, the requirement of claims 3, 17, 22, and 36 is described in the specifications of both the Provisional and Subject Applications in such a way as to reasonably convey to one skilled



in the relevant art that the inventor(s), at the time each of the applications was filed, had possession of the claimed invention.

The Requirement of Claim 5 that the Boiler is a Cyclone Boiler

Claim 5 requires that the boiler is a cyclone boiler.

As set forth in ¶¶9-10 of the Durham Declaration, this limitation is contained in the specifications of each of the Subject and the Provisional Applications. The Subject and Provisional Applications each specifically refer not only to the general class of boiler that includes the cyclone boiler, namely wet-bottom boilers, (Provisional Application at page 2; Subject Application at page 6, lines 15-18) but also specifically to cyclone boilers (Provisional Application at pages 1-5 and 7-8 and Subject Application at Figure 1, page 1, line 24 to page 2, line 19, page 5, lines 16-17, and page 6, lines 15-18). These references would convey to one skilled in the relevant art that the inventors, at the time the Provisional and Subject Applications were filed, had possession of the invention claimed in claim 5. (Durham Declaration at ¶10)

The Requirement of Claims 7 and 12 that the Solid Fuel is Pulverized Prior to Introduction into the Boiler

Claim 7 requires the additional step of pulverizing the solid fuel prior to introducing the solid fuel into the boiler.

Claim 12 requires the boiler to include a pulverizer for the solid fuel, a burner, a fuel transfer system, and a combustion chamber.

As set forth in ¶¶11-16 of the Durham Declaration, this limitation is contained in the specifications of each of the Subject and the Provisional Applications. The Subject Application discloses a “slag type” furnace in which a slag layer forms on a surface of the burner and captures coal particles for combustion. (Subject Application at page 1, lines 21-23) Both the Subject and Provisional Applications disclose a cyclone furnace or boiler and wet-bottom boilers as noted above. “Pulverized” coal boilers include both wet-bottom and dry-bottom boilers using a pulverized coal feed. A cyclone boiler is a type of wet-bottom

boiler for which the coal feed is crushed but not pulverized. A cyclone boiler is the only type of wet-bottom boiler which uses crushed but not pulverized coal feed.

While it is true that pulverizers and crushers are differing types of comminuting devices and produce different size distributions of coal feed, the reference to the genus “wet-bottom boilers” would reasonably convey to one skilled in the relevant art that the inventors, at the time the Provisional and Subject Applications were filed, had possession of the subject matter of claim 7. (Durham Declaration at ¶12)

As noted previously, the specifications of the Provisional and Subject Applications reasonably convey to one skilled in the relevant art that the inventors, at the time the Provisional and Subject Applications were filed, had possession of wet-bottom boilers, whether using pulverized or crushed coal feed. It necessarily follows that the pulverizer is located upstream of the combustion chamber. The burner is disclosed at page 2 of the Provisional Application and in Figure 1 of the Subject Application. The fuel transfer system is disclosed at page 7 of the Provisional Application and in Figures 4-5 and pages 14, lines 7-13 (coal feed pipes 244a,b) and 17, lines 14-15 (coal feed lines 344a,b). Finally, the combustion chamber is described at page 2 of the Provisional Application and in Figure 1 and at page 1, line 28, and page 2, lines 7-9, (combustion chamber 108) of the Subject Application. (Durham Declaration at ¶14)

For at least the reasons set forth above, the subject matter of claim 12 is described in the specifications of both the Provisional and Subject Applications in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time each of the applications was filed, had possession of the claimed invention. (Durham Declaration at ¶16)

The Requirement of Claim 14 that the Concentration of Iron-Bearing Material to Solid Fuel Is from about 0.5 to about 2.5 Weight Percent

Claim 14 requires that the concentration of iron-bearing material to solid fuel is from about 0.5 to about 2.5 weight percent.

As set forth in ¶¶17-18 of the Durham Declaration, filed concurrently herewith, this limitation is contained in the specifications of each of the Subject Application and the Provisional Application. The Provisional Application discloses, at page 8, a concentration of iron-bearing material to solid fuel of 20 lb/ton or 1 wt.%. The Subject Application discloses at page 9, lines 6-7, iron-bearing concentrations relative to the solid fuel of 10 lb/ton (or 0.5 wt.%), 20 lb/ton (or 1.0 wt.%), and 50 lb/ton (or 2.5 wt.%). For at least the reasons set forth above, the subject matter of claim 14 is described in the specifications of both the Provisional and Subject Applications in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time each of the applications was filed, had possession of the claimed invention. (Durham Declaration at ¶18)

The Requirement of Claim 29 that the Iron-Bearing Material Comprises from about 0.1 to about 10 Weight Percent of the Carbon-Containing Compound

Claim 29 requires the iron-bearing material to include from about 0.1 to about 10 weight percent of the carbon-containing compound.

As set forth in ¶¶19-21 of the Durham Declaration, filed concurrently herewith, this limitation is contained in the specifications of each of the Subject and Provisional Applications for the reasons set forth below. This precise concentration range is disclosed in the Subject Application at page 12, lines 17-18, which discloses that the additive can include “from about 0.1 to about 10 wt.% (dry basis) greases and oils.” The Provisional and Subject Applications further disclose additive carbon compound concentrations within this range at page 8 of the Provisional Application and page 15, lines 2-4, of the Subject Application (boiler slag in a concentration of about 2 to a about 20 wt.% and more preferably of about 2 to about 10 wt.%). The Subject Application discloses at page 13, lines 10-13, the addition of xanthum gum (or another organic adhesive) in a ratio of about 100:1 (or 1 wt.%) to 1000:1 (or 0.1 wt.%) parts additive to part adhesive. (Durham Declaration at ¶20)

As set forth in ¶21 of the Durham Declaration for at least the reasons set forth above, the subject matter of claim 29 is described in the specifications of both the Provisional and

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Subject Applications in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time each of the applications was filed, had possession of the claimed invention.

Because the Effective Filing Date of the Subject Application is the Filing Date of the Provisional Application, It Predates the Shepard Patent and Therefore Under Rule 608(a) No Prima Facie Showing of Entitlement to Judgment Is Required under MPEP§2308

MPEP§2308 and 37 CFR1.608(b) state that, when the effective filing date of a patent application is later than the effective filing date of a patent, evidence is required that the application is entitled to a judgment relative to the patentee. Here, the Shepard Patent was filed October 6, 2000, which is approximately three-and-one-half months after the Provisional Application was filed. However, the Subject Application was filed more than three months after the Shepard Patent. Because the pending claims are supported by the disclosure of the Provisional Application as well as the Subject Application, Applicant respectfully submits that the effective filing date of the Subject Application precedes the filing date of the Shepard Patent and such evidence is not required. The Examiner's failure to cite the Shepard Patent as prior art under 35 U.S.C. § 102(e) indicates that the Examiner is in agreement that the pending claims are supported by the Provisional Application.

In the Event that the Applicant Failed to Respond to the Office Action Within Any Non-Extendible Time Period under 37 CFR 1.607(b) and MPEP§2307.2, Applicant Respectfully Requests that Such Delay Be Excused and No Disclaimer Be Found to Exist

MPEP2307.02 requires an application seeking to invoke an interference with a patent to be handled with "special dispatch". When the Examiner sets a time limit for reply, the rule states that failure by the applicant to reply or appeal within the time limit will, in the absence of a satisfactory showing, be deemed a disclaimer of the invention claimed.

On July 23, 2004, Applicant discussed this rule with an interference specialist and was informed that the rule does not apply. The Office Action fails to refer to this section or to use the form ¶123.12 (MPEP at page 2300-14) but rather uses the standard form language

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for a non-final office action. Applicant first discovered Rule 2307.02 on July 22, 2004, when reviewing the MPEP in connection with responding to the Office Action.

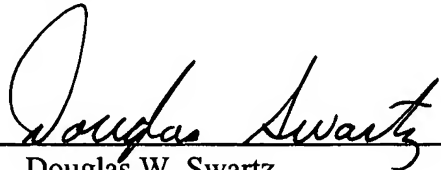
The reason for the three-month delay in responding to the Office Action is that Applicants have been in active negotiations with Crown Coal & Coke Co., the assignee of the Shepard Patent, in an attempt to resolve the dispute as to who is the first-to-invent the subject matter set forth in the proposed counts. A draft settlement agreement was exchanged. However, negotiations have not been successful. Accordingly, Applicants are proceeding in their attempt to have an interference declared.

In the event that MPEP Rule 2307.2 applies, Applicants request that Applicants' failure to reply by the three-month deadline (which Applicants assume would be the appropriate deadline in the event that the six-month statutory deadline is not the "time limit for reply" under Rule 2307.2) be excused for the reasons set forth above.

Based upon the foregoing, Applicants believe that all pending claims are in condition for allowance and such disposition is respectfully requested. In the event that a telephone conversation would further prosecution and/or expedite allowance, the Examiner is invited to contact the undersigned.

Respectfully submitted,

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